package: marine acoustics R Documentation

**Calculation and graphs of underwater acoustic transmission loss (TL) models**

*Description:*

Set of functions to generated graphics and calculations of simple geometric transmission loss models and a semi-empirical model for shallow water transmission loss developed by Marsh and Schulkin (1962) known as "Colossus". Units are measured in decibel (dB rel 1µPa) as standard for underwater acoustics.

*Usage:*

TL.function()

*Arguments:*

Arguments for function are given from prompts that query the user.

First the user chooses the transmission loss models to be used:

**MS or GEO?**

**MS** for the Marsh and Schulkin (1962) semi-empirical model

**GEO** for the geometrical models

When geometrical models are choose (GEO) the user is query about model type:

**What is the model?**

**esf** for spherical transmission loss

**cil** for cylindrical transmission loss

**pra** for practical transmission loss

Both models also have prompts for frequency and range parameters:

**Insert f** insert frequency of the acoustic signal kilohertz (kHz)

**Insert r** insert range for the transmission loss calculation expressed in meters (m) for GEO models and kilometers (km) for MS model

Additionally MS model have prompts for further parameters:

**Insert L** insert the depth of the surface isothermal layer of the ocean area in in meters (m)

**Insert D** insert the total depth of the ocean in meters (m)

**Insert at** insert the effective shallow water attenuation coefficient in dB according to the sea state (beaufort scale) and bottom type (sand or mud) as present in the Marsh and Schulkin (1962) table.

**Insert kl** near-field anomaly (dB) according to the sea state (beaufort scale) and bottom type (sand or mud)as present in the Marsh and Schulkin (1962) table

*Details:*

All models included the coefficient of absorption (alpha) formula from Thorp (1967):

where f is the frequency in kHz.

Results are in dB/km.

*Value:*

Graphic functions return a plot of the transmission loss in dB (y axis) from the frequency defined by the user according to a range from 25m to 1km (x axis).

Transmission loss value functions return the result from the selected transmission loss model in dB (geometric models or MS semi-empirical) according to the range defined by the user.

*Warning:*

When using geometric models the input range must be expressed in meters (m) and when using the semi-empirical MS model input range must be expressed in kilometers (km).

*Note:*

MS model or Colossus is a model for shallow water usage (up to 200m depth. The frequency range spans from 0.1 to 10 kHz, sea estate from 0 to 5 in the beaufort scale and selected bottom types can be chosen between sand or mud. MS model assumes a bilinear sound speed gradient composed of a constant positive linear layer from the surface to the depth of maximum sound speed (or temperature defined as the thermocline) and a constant negative linear sound speed gradient bellow the depth of maximum sound speed.

*Author(s):*

Alexandre Douglas Paro

*References:*

Marsh, H.W and Schulkin, M. 1962. Shallow water transmission. *Journal of the Acoustic Society of America* 34: 863-864.

Thorp, W. H. 1967. Analytic description of the low‐frequency attenuation coefficient. *The Journal of the Acoustical Society of America* 42.1: 270-270.

Beaufort scale available in: www.en.wikipedia.org/wiki/Beaufort\_scale

*See Also:*

function for basic mechanisms for defining new functions in the R language.

*Examples:*

TL.function()

#MS or GEO?

GEO

#What is the model?

pra

#Insert f

1

#Insert r

500

##transmission loss value for a 1 kHz signal over 500m and graphic using practical geometric transmission loss model.

TL.function()

#MS or GEO?

MS

#Insert f

0.3

#Insert r

0.6

#Insert L

5

#Insert D

20

#Insert at

1.9

#Insert kl

5.9

## transmission loss value and graphic of the Colossus model value for a 0.3 kHz signal over 600 m, isothermal layer of 5 m, depth of 21.5 m, at and kl for a 0 sea state and sand bottom.